Dating calcareous sinter deposits from Roman aqueducts by combined use of U, Th, Ra and Ba isotopes

M.-L. FROESCHMANN[1*], D. SCHOLZ[1], C. PASSCHIER[1], G. SÜRMELIHINDI[1], H. VONHOF[2], K. P. JOCHUM[2]

[1]Institute for Geosciences, Johannes Gutenberg University, Mainz, Germany (*correspondence: mfroesch@students.uni-mainz.de
[2]Max Planck Institute for Chemistry, Mainz, Germany

Calcareous sinter deposits from Roman aqueducts are important archives that offer the possibility not only to reconstruct the paleoclimate from the Roman Imperial Period (27 BC to 476 AD) but also to gain important insights from an archaeological point of view. To put this information into context, it is necessary to precisely date the deposits. One of the most commonly used methods for dating carbonates is the ^{230}Th/U-disequilibrium method. However, this is – in many cases - challenging since the sinter deposit can contain a substantial amount of detrital material. This detrital material, as indicated by high amounts of ^{232}Th in the sample, may have a substantial effect on the precision of the U/Th-ages [1]. This, in turn, limits the potential of the corresponding samples for paleoclimate reconstruction.

Here we present a new approach for dating aqueduct sinter samples using a combination of U, Th, Ra and Ba isotopes. The separation of these elements from the carbonate matrix is performed from a single aliquot of material by running it through multiple columns containing different ion exchange resins. The individual fractions are measured by Multi-collector ICP-MS. Corrected ages are derived using a novel isochron technique involving all isotope systems. The results of this new approach are compared to model simulations and to ages obtained with the conventional ^{230}Th/U-method.

The new method is not only interesting for aqueduct sinter, but also for other carbonate deposits, such as speleothems, and can be applied to Holocene samples with an age of up to 8 ka.

[1] Wenz *et al.,* (2016) *Quat. Geochronol.,* **32**, 40-52.